MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2015/2016

TSN2101 – OPERATING SYSTEMS / TOS2111 – OPERATING SYSTEM 1

(All sections / Groups)

31 MAY 2016
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 5 pages with 6 Questions only.
2. Attempt **FIVE** out of **SIX** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

QUESTION 1

a) Describe any five services provided by an operating system to make it more convenient for users to use the computer system. **[5 marks]**

b) In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can result in various security problems. **[2 marks]**
   i) What are two such problems?
   ii) Can we ensure the same degree of security in a time-shared machine as we have in a dedicated machine? Explain your answer.

c) Describe the 5-states process model. Explain as clearly as possibly what properties distinguish processes in the different states and how processes move from one state to the next. **[5 marks]**

QUESTION 2

a) Describe the differences between symmetric and asymmetric multiprocessing. What are three advantages of multiprocessor systems? **[3 marks]**

b) Cooperating process can affect or be affected by other processes, including sharing data. **[3 marks]**
   i) What are the four reasons for cooperating processes?
   ii) What are the two models of inter-process communication (IPC)

c) What two advantages do threads have over multiple processes? What major disadvantage do they have? **[3 marks]**

d) Multicore systems present certain challenges for multithreaded programming. Briefly describe these three challenges. **[3 marks]**

QUESTION 3

a) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds: **[4 marks]**

Process	Burst-time	Arrival time
P1	8	0
P2	5	1
P3	9	3
P4	4	5
P5	6	7

Continued ...

i) Draw the Gantt charts illustrating the execution of these processes using
   a) preemptive shortest job first SJF
   b) RR (quantum=2) scheduling.

ii) Which algorithm gives the minimum average waiting time?

b) The following program segment is used to manage a finite number of instances of an available resource. The maximum number of resources and the number of available resources are declared as follows:

```
#define MAX_RESOURCES 5
int available_resources = MAX_RESOURCES;
```

When a process wishes to obtain a number of resources, it invokes the decrease_count() function:

```
/* decrease available_resources by count resources */
/* return 0 if sufficient resources available, */
/* otherwise return -1 */
int decrease_count(int count) {
        if (available_resources < count)
                return -1;
        else {
                available_resources -= count;
                return 0;
        }
}
```

When a process wants to return a number of resources, it calls the increase_count() function:

```
/* increase available_resources by count */
int increase_count(int count) {
        available_resources += count;
        return 0;
}
```

The preceding program segment produces a race condition. **[3 marks]**

i) Identify the data involved in the race condition.
ii) Identify the location (or locations) in the code where the race condition occurs.
iii) Using a semaphore, fix the race condition.

Continued ...

c) Consider the following system with **FIVE** processes and **THREE** resource types:

- A has 8 instances
- B has 8 instances
- C has 8 instances

The snapshot of the system is given as:

Process	Allocation A B C	Max A B C
P0	0 1 1	7 5 3
P1	2 1 0	3 2 2
P2	3 0 2	6 0 2
P3	1 2 1	3 2 4
P4	1 0 2	4 7 8

Available A B C
1 4 2

Answer the following questions using the banker's algorithm:

i) What is the content of the matrix *Need*? **[1 mark]**

ii) Find a sequence of processes that will get the system into a safe state, if there is any. Show all required steps. **[3 marks]**

iii) P4 makes a request for 3 instances of B and 1 instance of C. Check whether the request can be granted immediately. **[1 mark]**

QUESTION 4

a) Processes may attempt to access an illegal page in memory. How are illegal page addresses recognized and trapped by the operating system? **[4 marks]**

b) Consider a computer system with a 32-bit logical address and 4 KB (1 KB = 1024) page size. The system supports up to 2048 MB of physical memory. How many entries are there in each of the following: **[2 marks]**

- A conventional single-level page table
- An inverted page table

c) Identify the page numbers and offsets for the following address references (Given as decimal numbers). Assume the page size is 6 KB (1 KB = 1024). **[3 marks]**

- 40000
- 512
- 6184

d) Standard swapping involves moving processes between main memory and a backing store like a fast disk. Assume the following characteristics: **[3 marks]**

Continued ...

- Size of user process to be swapped out/to be swapped in: 100 MB
- Transfer rate of backing store (hard disk)/second: 25 MB
- Average Latency Time: 5 ms

Identify

- Total transfer time to main memory from backing store/from main memory to backing store
- Swap-out/Swap-in time which includes both transfer time and average latency time
- Total Swap Time which includes both swap-out and swap-in times.

QUESTION 5

a) The second-chance algorithm is based on the FIFO replacement algorithm. How does the second-chance algorithm for page replacement differ from the FIFO page replacement algorithm?

[2 marks]

b) Consider the following page reference string:

5 3 5 2 1 2 3 5 4 2 3 6 5 1 6 3

Assume the availability of **FOUR** frames and all the frames are initially empty. Consider the **First-In-First-Out (FIFO)**, **Least Recently Used (LRU)** and **Optimal (OPT)** page replacement algorithms for Virtual-memory management.

- Identify the number of page faults that would occur if FIFO is used.
- Identify the number of page faults that would occur if LRU is used.
- Identify the number of page faults that would occur if OPT is used.

Show all steps involved.

[2 + 2 + 2 = 6 marks]

c) Given a system with four page frames, the following table indicates page number, load time, last reference time, dirty bit, and reference bit. Value of reference bits for all the three pages after the last tick is given below.

[4 marks]

Page number	Load time	Last reference time	Dirty bit	Reference bit
0	5	65	1	0
1	15	45	1	1
2	10	85	0	0
3	20	55	0	1

Continued ...

Identify the victim for the following algorithms.

i) First-In-First-Out (FIFO)
ii) Least-Recently-Used (LRU)
iii) Reference bit – Dirty bit combination
iv) Second Chance

QUESTION 6

a) Consider a file system that uses a modified contiguous-allocation scheme with support for extents. A file is a collection of extents, with each extent corresponding to a contiguous set of blocks. A key issue in such systems is the degree of variability in the size of the extents. What are the advantages and disadvantages of the following schemes?

[3 marks]

i) All extents are of the same size, and the size is predetermined.

ii) Extents can be of any size and are allocated dynamically.

iii) Extents can be of a few fixed sizes, and these sizes are predetermined.

b) Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 1140, and the previous request was at cylinder 1120. The queue of pending requests, in FIFO order, is

50, 1350, 810, 1650, 940, 1200, 1420, 1730, 150

Starting from the current head position, what is the schedule and the total distance that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms?

[3 + 3 = 6 marks]

i. FCFS
ii. SCAN

c) What are the factors influencing the selection of a disk-scheduling algorithm?

[3 marks]

End of Exam